

Applying the Sub-Daily SWAT Model to Assess Erosion and Flood Potential under Different Development Scenarios in the Austin, Texas Area

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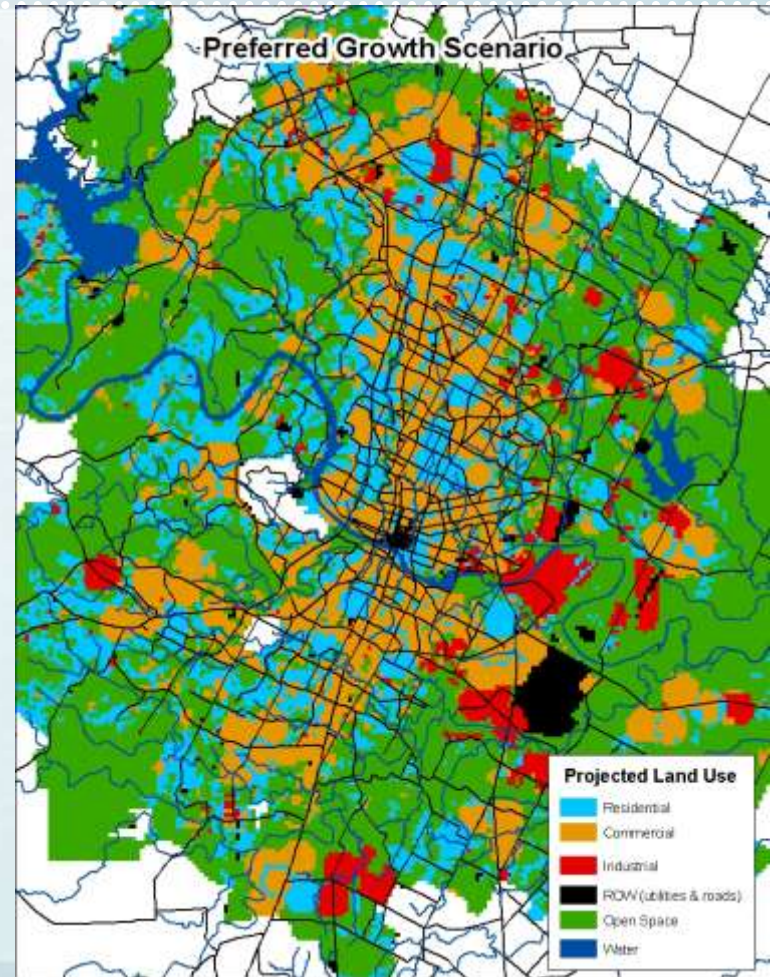
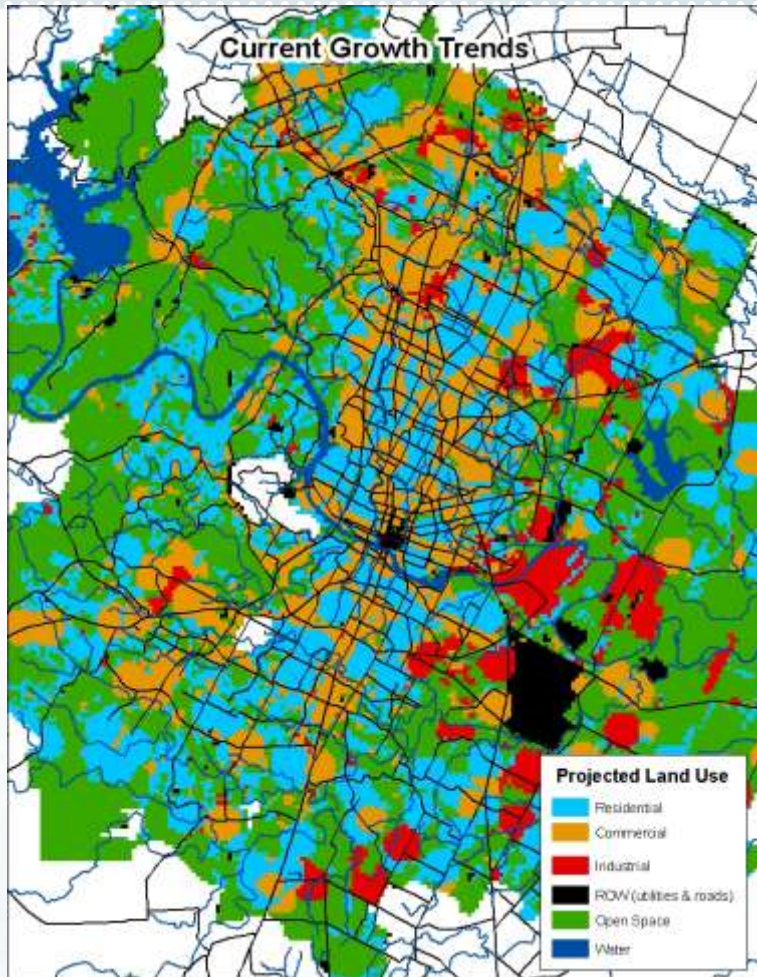
City of Austin, Texas

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Differing Growth Scenarios

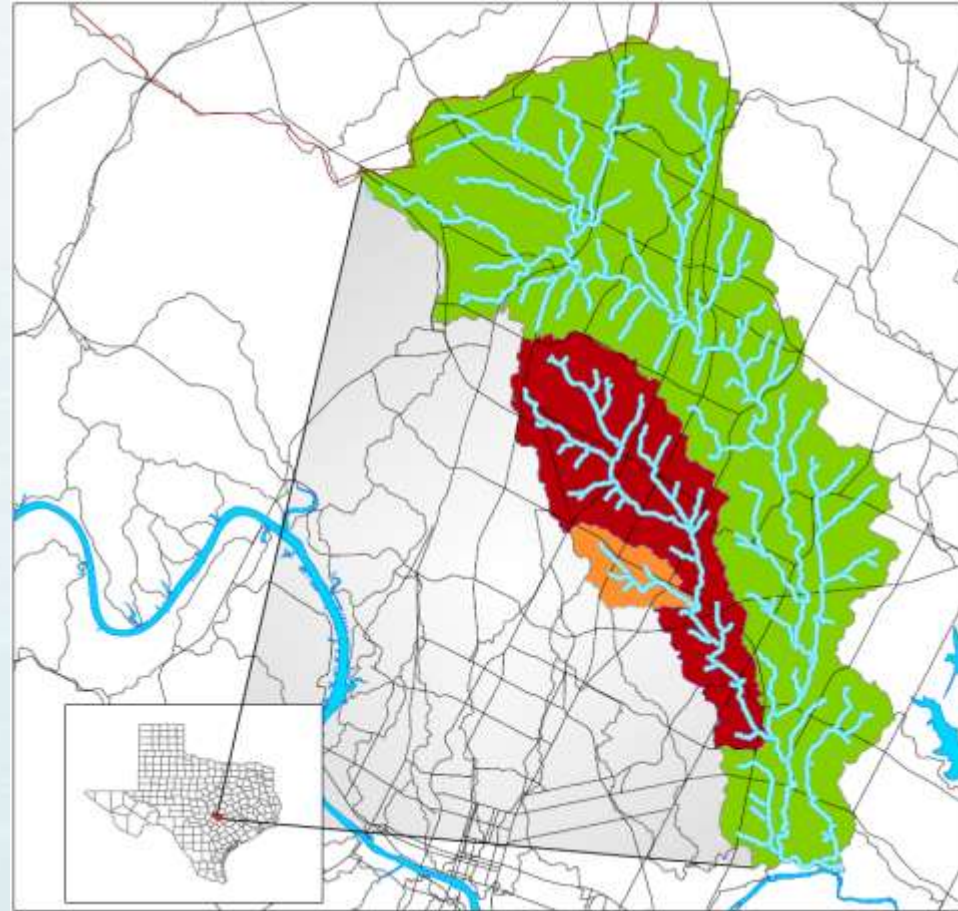


Purpose and Objectives

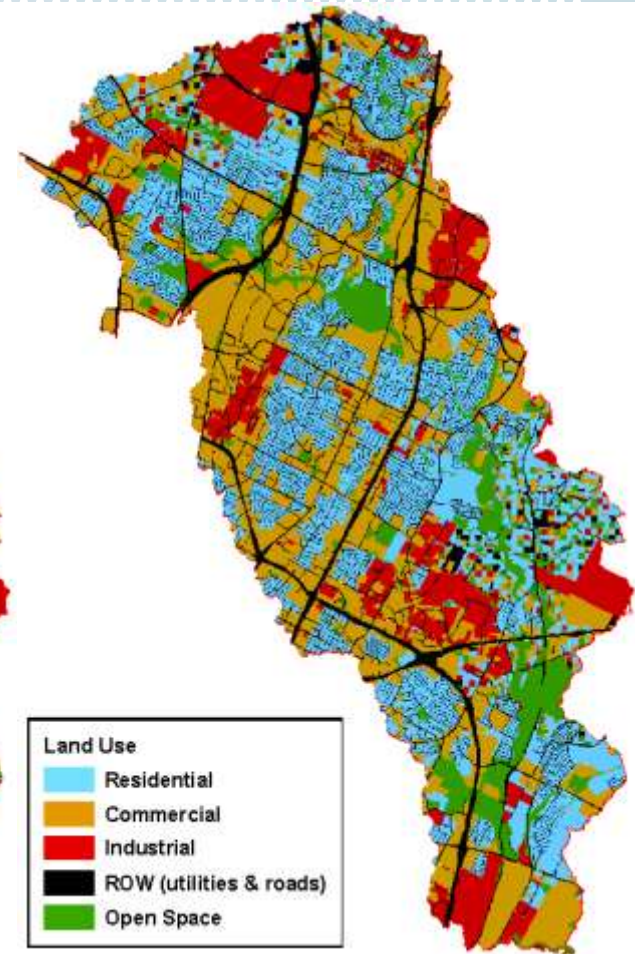
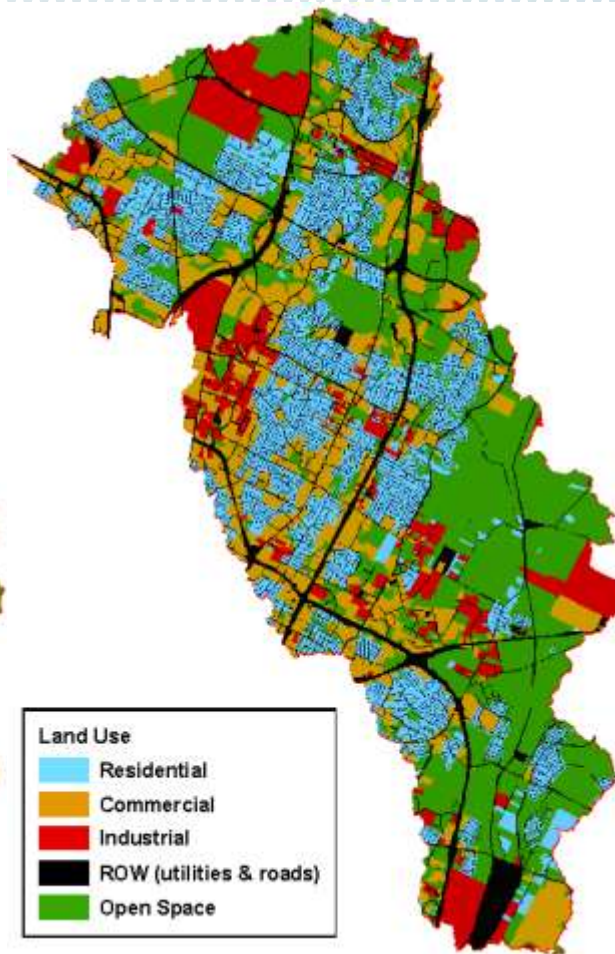
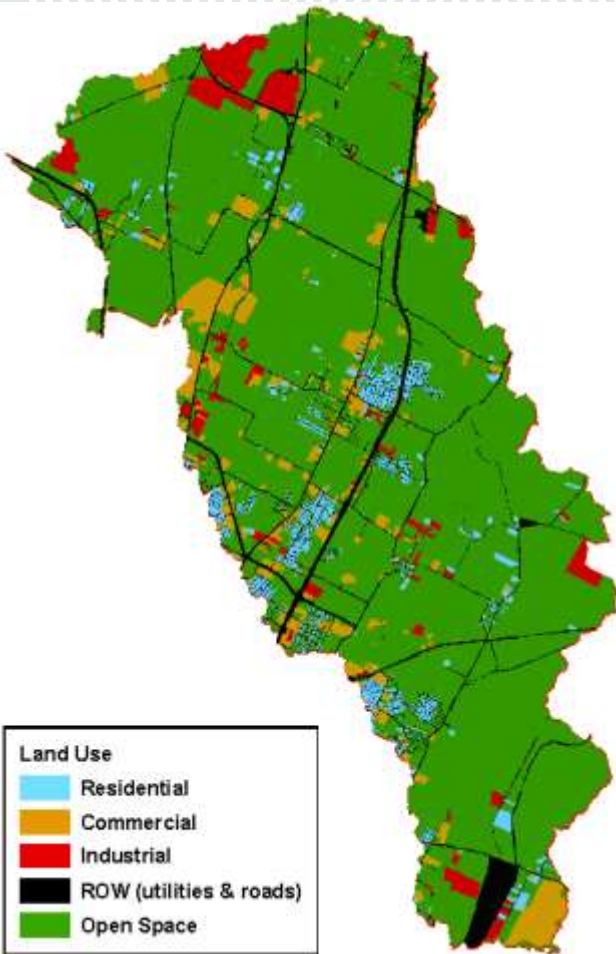
- Evaluate changes in the flood regime at different locations with respect to frequency and duration
- Evaluate changes in erosion potential at different locations with respect to cumulative excess shear

Study Area - Walnut Creek

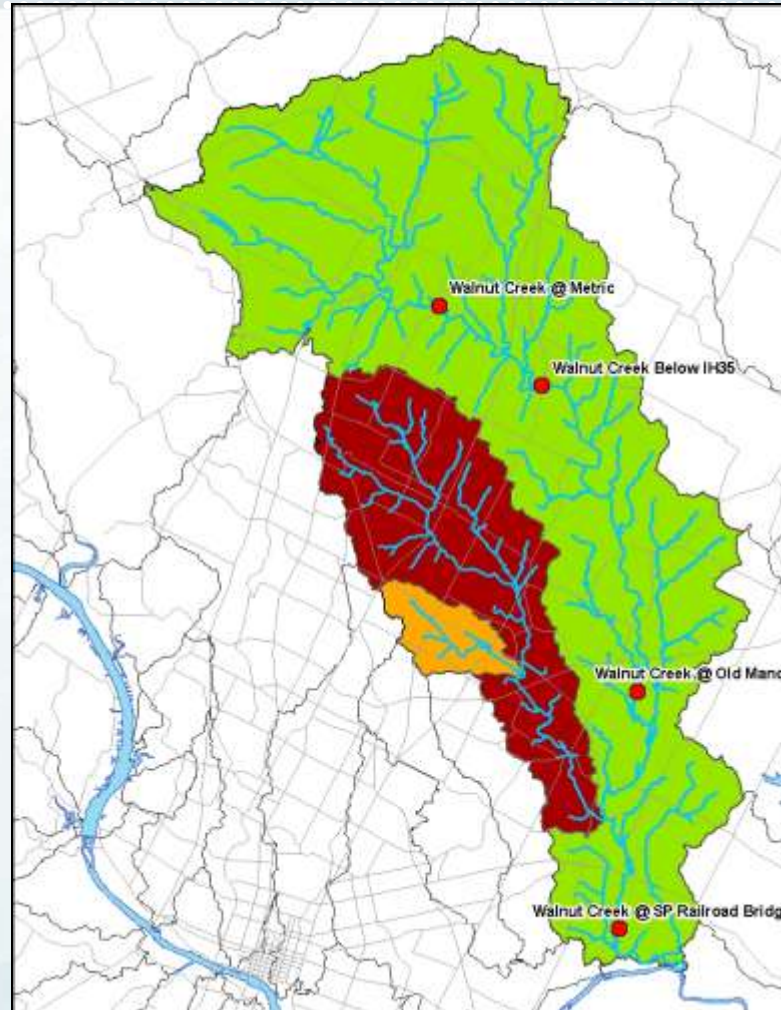
- 145.8 km² watershed
- USGS gage data 1967 to present
- 3-m DEMs
- SURRGO Soils
- 15-minute rainfall at 18 gauges
- Lot level land use
- 298 sub-basins
- ~4500 HRUs
- Sub-daily
 - NSE = 0.74
 - $r^2 = 0.78$



Walnut Land Use Scenarios



Flood and Erosion Evaluation Sites



Walnut @ Metric Blvd



Walnut @ I-35



Walnut @ Old Manor Rd

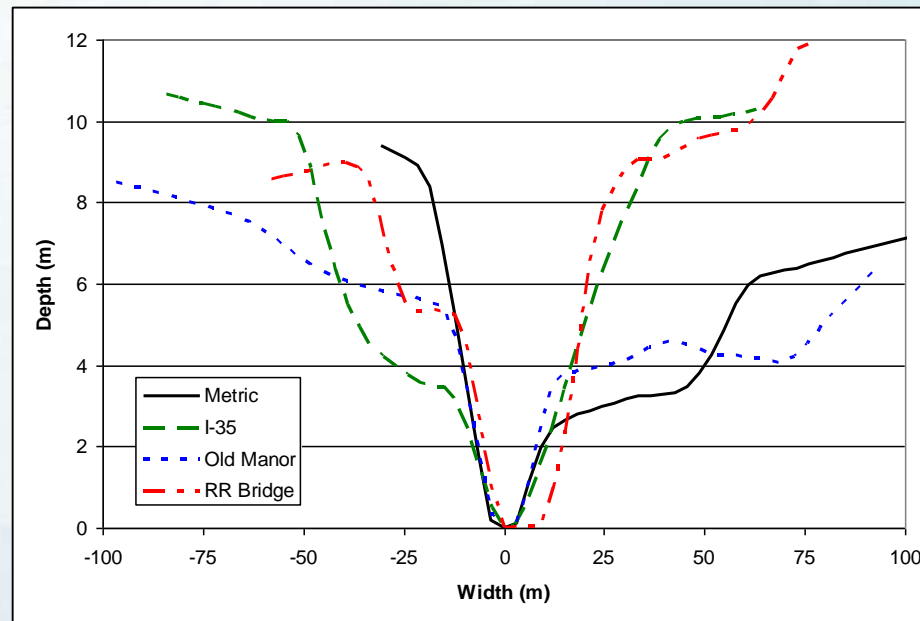


Walnut @ SPRR Bridge

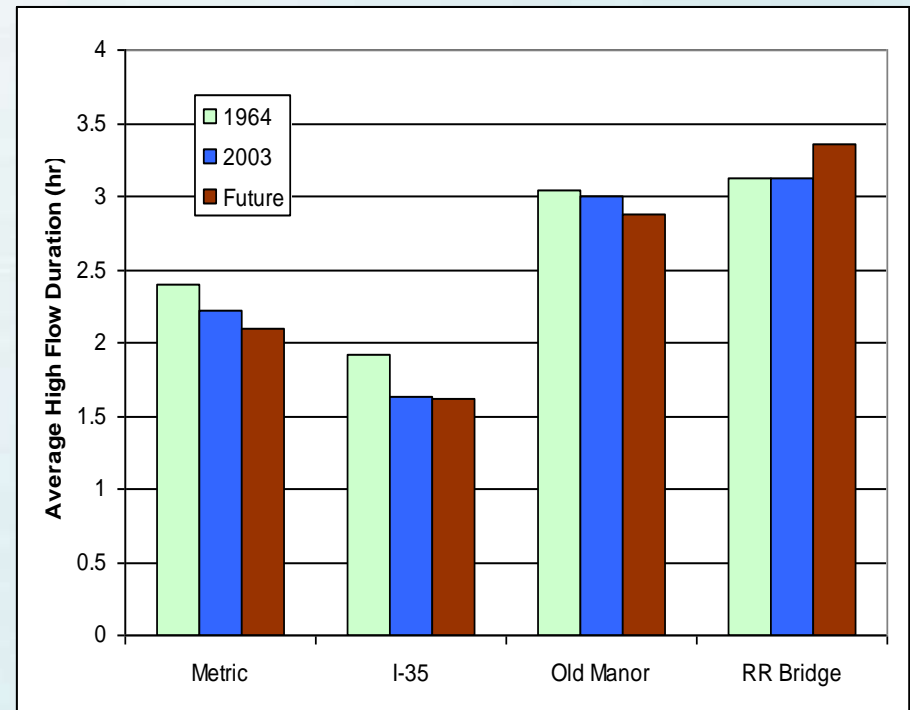
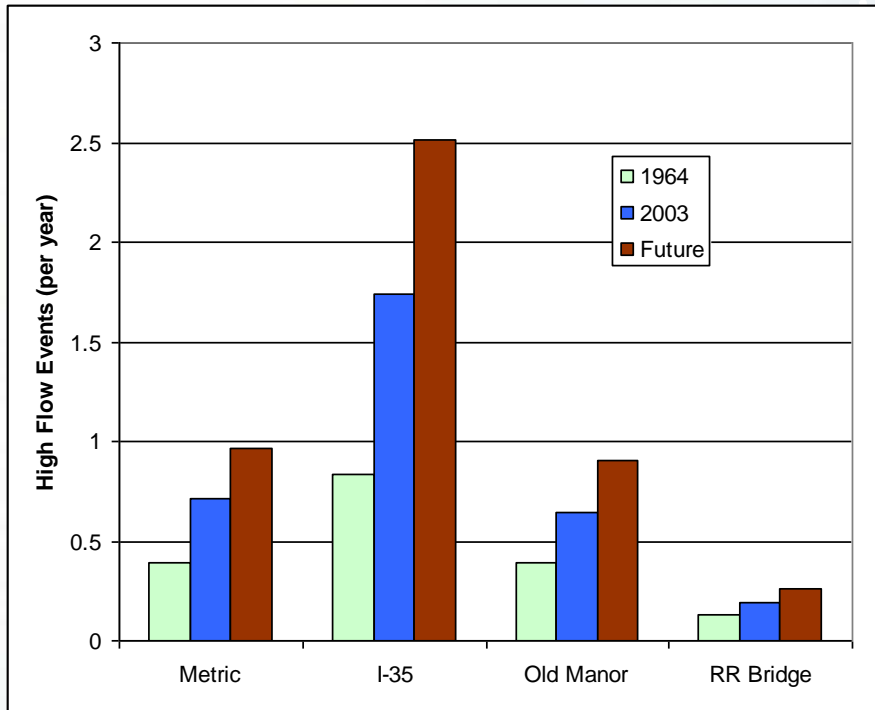


Channel Cross-Sections

Site Name	Slope (m/m)	Depth (m)	Width (m)	Q bank-full (m ³ /s)
Metric Blvd	0.0059	2.44	19.81	62.0
I-35	0.0045	3.05	25.60	119.0
Old Manor Road	0.0012	3.35	21.18	110.0
SP Railroad Bridge	0.0042	5.18	32.00	225.0



Flood Evaluation



Erosion Evaluation

Manning's n estimated by slope and hydraulic radius (Jarrett1984):

$$n = 0.39S^{0.38}R^{-0.16}$$

Shear and critical shear were computed by:

$$\tau = \gamma_w \bullet D_H \bullet S_w$$

$$\tau_c = \theta_c (S_g - 1) \bullet \gamma_w \bullet d_{50}$$

where,

γ_w = density of water

D_H = depth of water

S_w = channel slope

S_g = specific gravity of soil, 2.65

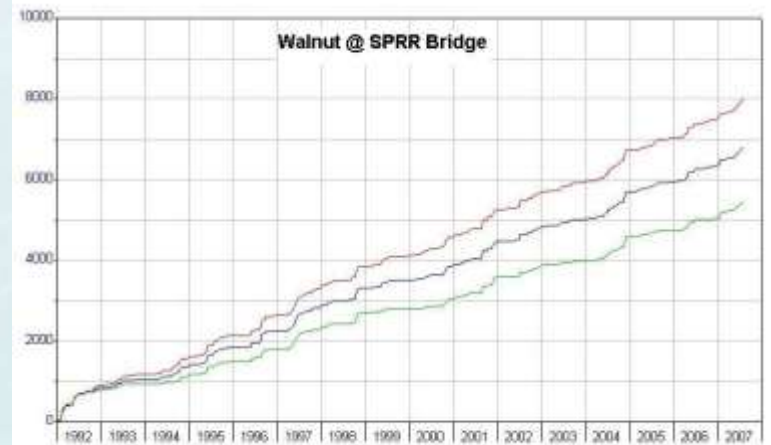
d_{50} = median particle diameter, mm

θ_c = critical Shield's parameter, 0.047

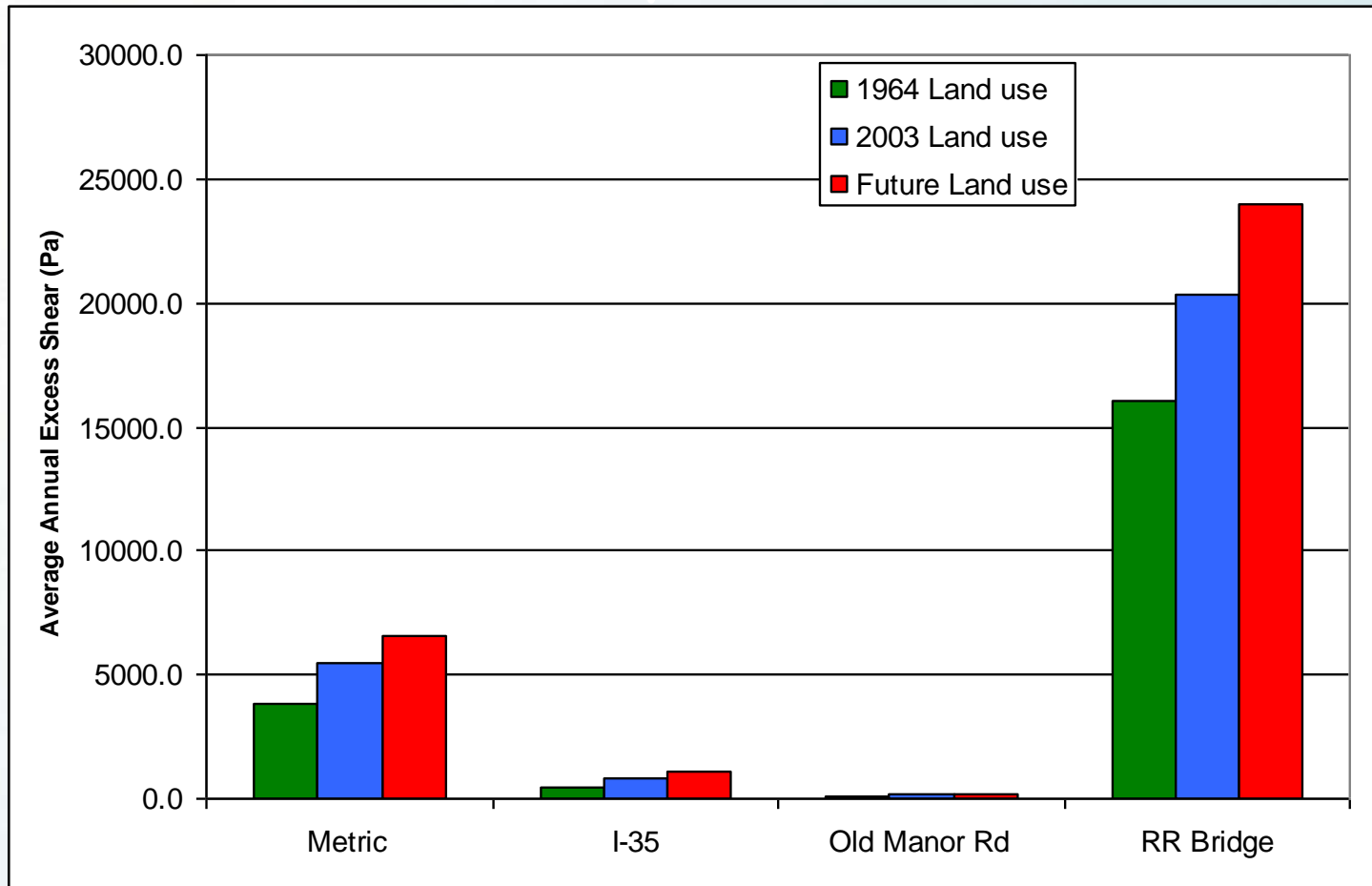
Erosion Evaluation

Site Name	d_{50} min (mm)	d_{50} max (mm)	τ_c min (Pa)	τ_c max (Pa)	τ_c avg (Pa)
Metric Blvd	30	43	22.80	32.69	27.75
I-35	54	75	41.05	57.01	49.03
Old Manor Road	19	27	14.44	20.52	17.48
SP Railroad Bridge	14	21	10.64	15.96	13.30

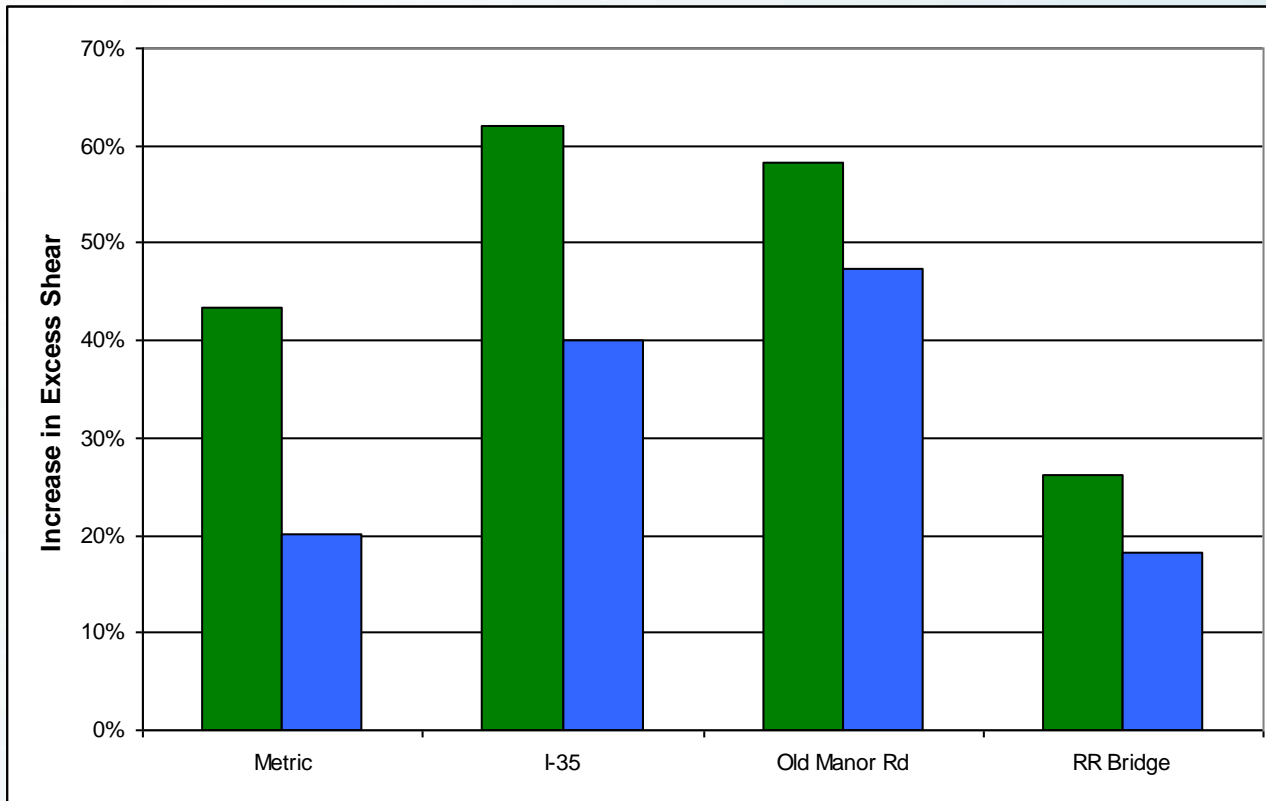
Erosion Evaluation



Erosion Evaluation



Erosion Evaluation



Conclusions

- Sub-daily flow results from SWAT may be used to evaluate flood and erosion impacts of land use change
- Flood frequency increases and duration decreases with increased urbanization
- Excess shear increases with increased urbanization but site characteristics influence the magnitude of the increase

Questions?

